REPORT

FROM

THE SECRETARY OF THE TREASURY,

WITH A

Report of F. R. Hassler, superintendent of the fabrication of standard weights and measures.

JULY 4, 1838.

Referred to the Committee on Commerce, and ordered to be printed.

TREASURY DEPARTMENT,
July 3, 1838.

SIR: For the information of the Senate, I have the honor to transmit, herewith, a report, made to this department by F. R. Hassler, Esq., superintendent of the work for the fabrication of standard weights and measures. He represents that complete sets of standard *weights* for the respective States of the Union have been prepared and are now ready for delivery, and gives directions as to their use. This work has been done as directed by the joint resolution of Congress, approved the 14th of June, 1836, as follows: "*Resolved*, That the Secretary of the Treasury be, and he is hereby, directed to cause a complete set of all the weights and measures adopted as standards and now either made or in the progress of manufacture, for the use of the several custom-houses and for other purposes, to be delivered to the Governor of each State in the Union, or such person as he may appoint, for the use of the States respectively, to the end that an uniform standard of weights and measures may be established throughout the Union." Immediate notice will be given to the Executive officers of the States, in order that their directions may be obtained as to the person and manner of their delivery.

The superintendent is actively engaged in the preparation of the measures of capacity and length, also referred to in the resolution; and when completed and ready for delivery, the course pointed out by Congress will be duly complied with in regard to them.

All which is respectfully submitted.

LEVI WOODBURY,
Secretary of the Treasury.

Hon. WM. R. KING,
President of the Senate.

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Report to the Treasury Department of the United States, upon the construction and completion of the standards of weights for all the States of the Union, by F. R. HASSLER.

I have the honor to inform you that I have completed the execution of the *first part* of the joint resolution of both Houses of Congress, of the 14th of June, 1836; namely, the construction of the uniform standards *of weights* for all the States, and that the same are now ready for delivery.

Each set of weights for one State consists of the following weights:

One 1 pound troy.
One 1 pound avoirdupois.
One 2 pound avoirdupois.
One 3 pound avoirdupois.
One 4 pound avoirdupois.
One 5 pound avoirdupois.
One 10 pound avoirdupois.
One 20 pound avoirdupois.
One 25 pound avoirdupois.
One 50 pound avoirdupois.

It is easily seen how 100 lb. &c. can be combined by their means when desired. The eight first weights are contained in one box, the two last in another, and they are together fitted again into one box for transportation. The inner boxes are lined with velvet, and each weight has its special cavity, which cannot be mistaken; in the bottom of it the value of the weight is marked. The tops of the boxes are screwed down with knobs upon brass rods, which guide the cover; they keep the upper part tight, so as to prevent all shaking of the weights by transportation. Upon the weights themselves, only a light stamp of an eagle is made, to denote the authenticity of the weight; (the small figures, stamped upon many, being only references to the private register of the weighings referring to our journals.)

It is a subject of great gratification to me to have been enabled, in the short time of two years, to execute a task, which has been so much and so long desired in the country, to the extent that each State becomes at once, simultaneously and equally, supplied with these standard weights, by which, of course, the anomalies unavoidable in simple copying (which would have been the consequence of a partial delivery) is avoided; thus security of uniformity is established for the future, provided the proper care is taken for their preservation, and the preventing of accidents, according to the instructions which I shall join hereto.

The preparation of the metal for these standards, and the mode of their mechanical construction, has been stated already in some of my several previous communications.

The method of combined weighing, which I have described in my report of November last, as applied to the mint weights, has been equally applied to these weights for the States, in their ultimate adjustment, up to the 50 lb. weights, which it was not convenient, nor necessary, to treat in the same manner. The accuracy which this method of weighing affords, has been shown in the report quoted, and I can add to it only: that it has been obtained, not only proportionally, but even almost identically the same in all the larger weights of these standards.

To be enabled to produce these results, in weights of the size of those required for the sets of standards, it was necessary to construct, in the establishment itself, appropriate balances of large size, and peculiar construction, with an accuracy, and strength, far superior to what has ever been habitual. Brass beams of two, somewhat considerable, dimensions, supported upon metal columns, and with peculiar arrangements, have afforded the most satisfactory results, and the desired acceleration in the final adjustment has been the consequence of it. But the assiduity and attention required are such, that the persons employed in the mechanical part of the weighing of the larger weights, were more than once entirely exhausted by the long protracted task.

All those standard weights have been adjusted by myself personally, which have served for the establishment of the multiples, and always such individuals were selected, as would produce by their sum, the fullest exactitude of the intended large weights.

Of all and every operation of weighing, regular journals were kept, in which each individual weighing, as well as the detailed results were registered, as soon as made, so that they might serve in future for any investigation that could be found desirable, similar to the habit in astronomical observation made in an observatory, and as I practice in all the operations for the coast survey.

To determine the avoirdupois pound from the troy pound, which is the only British standard, adopted as such, and made with proper authenticity, was again an operation in some respects similar to that which I had to perform for the system of ounce weights.

The awkward ratio of 5,760 grains for the troy pound, to 7,000 for the avoirdupois pound, renders its determination very precarious when done by the means of the grain weights, quoted in the legal statement, as there is no easy common divider between the two numbers; in fact I believe that in England itself the habitual execution of this proportion is not regarded with much confidence. A similar inference might already be drawn from the fact made apparent in my report upon standard comparisons in 1832, page 30; in the last column of the table, where I deduced the value of the pound avoirdupois, that would result from each of the standards of the State Department, which are furnished with full parchment documents, stating their veracity, &c., it will be seen that the pounds deduced from the different weights vary differently between 6997.95 grains and 7001.1 grains (in the extremes) expressed in mint weights, and, for instance, the 28lb. differs for 24½ grains, and 56lb. for 93, from their legal nominal value.

The two avoirdupois pounds procured from England did not present fully the desired ratio, nor did they agree with each other within such a limit, as I could not easily discover the difference.

Having established the weight of the ounce, and its subdivisions, and multiples, from the troy pound, by the method of combinatory subdivisions, and ultimate verification, by combined weighing, (as related in my report of last November,) in such a manner as to reduce the possible differences, or anomalies, to the smallest possible degree, I considered myself better able to establish an avoirdupois pound of the true legal ratio, than the weights received from London, as such were representing, their difference besides indicated already the propriety of relying rather upon the means which I had established upon good principles, than upon the servile copying of either, or the taking of a mean between the two.

Other experiences moreover indicated to me the propriety of such a course in the settlement of this question, which is evidently left too much in the vague, by the law giving no rule, of easy following, by which to establish the avoirdupois pound, from the actual standard, the troy pound.

The troy pound which I had brought from Europe with me, already in 1805, had at that time been found exactly equal to that of the mint of Philadelphia, received by authority from England, the new troy pound, of which an authentic copy had been procured for the same mint, proved according to my comparison, of which I rendered account in 1832, to exceed this old pound of mine, which has always been carefully preserved, by 2.41 grains; a difference equal to the mean between the deviations discovered by Sir George Schuckburg, 1796, and that which had been found almost simultaneously with me, by Dr. Moll, in Utrecht.

These, and, I suppose, other similar facts, proving that the British mint weights were too light, a declaration to that effect took place in England by authority, depreciating the coins made before 1828, for the value of $1\frac{1}{2}$ grain of the precious metal they should represent.

The troy pound which I had procured from Troughton and Simms of London, when I began the construction of standards, proved to agree exactly with the one of the mint, declared standard for the United States by act of Congress, in 1828. But a second troy pound, procured about a year ago, proved so much lighter, that I found it not proper to put any reliance upon it.

I found best to start, for all weights whatever, from the unique weight, which I had found coincident with that of the mint, and to use my results of the ounce weights and their subdivisions, as deduced from the combined weighings, upon which I considered myself authorized to lay more confidence, for the establishment of the other weights.

Another accessory circumstance is that the weights which I received after the first troy pound have large letters and other indications engraved upon them, which collect always more or less dust, or soil, and render it uncertain under what circumstances, in that respect, they may have been determined, or under which they may be at the time I would use them; for it must be observed that the rubbing for cleaning in the cavity is not admissible, as it would easily take more weight away than (I may be allowed to state, that) any of my weights can deviate from the truth; a slight rubbing with an oiled leather, as otherwise had been considered allowable for cleaning weights, I have found to alter them far more than I ever allowed standard weights to differ.

To adopt the grain weights from England for the completion of the difference between the pound troy and the pound avoirdupois, I considered inadmissible, on account of the accumulation of the small errors that may occur in their construction. I used only one 40 grain weight to make up the ultimate complement to the avoirdupois pound; this was one equally verified by combinatory weighing. Considering myself thus fully authorized to stand upon my own ground in the establishment of a proper avoirdupois pound, that would have the due ratio to the troy pound, as stated by law, I established the standard avoirdupois pound by the following weights:

	Grains.
1. Simms troy pound, affording - - - -	5,760
2. One two-ounce weight of my construction - -	960
3. One half-ounce weight of the same - - -	240
4. One forty-grain weight, determined by combination -	40
Making the total avoirdupois pound - - -	7,000

With this I compared again, by combined weighing, three different combinations of the ounce weights, and I included the avoirdupois pound received from London and marked A, which was nearest coinciding with my results for the ounces, adding for its defect as deduced from determinations which I had previously made. Thus I obtained five weights, to verify by combined weighing, which established by their mutual confirmation the standard avoirdupois pound, which I adopted, and upon which, therefore, also the heavier weights are grounded, by combining an adequate and selected number of them.

By these methods and combinations, I hope that I have obtained a degree of accuracy fully satisfactory, and superior to whatever may be considered as of influence in any practical use of these standards.

F. R. HASSLER.

WASHINGTON CITY, *June* 26, 1838.

INSTRUCTION,

Relating to the use of the standard weights.

1. Never touch the weights with the hand, in no case whatsoever.

2. The weights are to be lifted out and in their proper places, and in any case of their being moved, by means of the fork, or hook, covered with leather, which is added to the boxes for that purpose, and fitting the different weights.

3. When the weights are taken out of the box, they must always be placed upon clean white paper, that they may not become scratched or soiled, as well when placed on a balance as otherwise.

4. The whole collection must be kept in a safe and dry place, free from all disturbances or danger of damage.

5. They must never be moved away from under the care of the officer under whose charge they are, to any other building or place, to make comparisons; but any weights to be compared must be brought to the place of deposite of the standards, to undergo the comparison.

6. To make a good comparison, the weight standard must be placed in one of the basins of the scales, and in the other must be put any heavy bodies, to make exact counterpoise to the same; when thus an exact equilibrium is obtained, the standard weight is removed, and in its stead the weight to be compared is placed. Whatever may have to *be added to the weight compared*, for so much it is too *light*, whatever may be needed to *add* to the *counterpoise*, will indicate the weight compared so much too *heavy*.

7. That the utmost caution is to be observed in the use of the weights

will be self-evident. In all cases, the weights must not be left exposed to the open air, when not absolutely necessary.

8. As the standard weights have all their proper legal weight, it is proper to observe that, in comparing rough weights for common mercantile use, there ought always to be a certain allowance made for the wear of such weights in their use, by an over weight approportioned to the magnitude, the kind of use the weight is intended for, and the usage which it may have to withstand; as, after a while, such weights would otherwise, too soon, become too light, and deviate too much from the accuracy that may be wished in them: by this allowance they remain longer near enough to the desired accuracy, before needing new adjustment.

9. The value of each weight is marked upon a paper, fastened to the bottom of its place in the box, (in preference of stamping it upon the weights,) so that the removal of the weights can never disturb them, the fitting of the weights not admitting of their being misplaced; it is only to be observed that these papers must never be removed.

10. The boxes are expressly made without locks; the cover must be lifted up straight, as the brass bars at the sides direct. When the weights are in, the cover must be screwed down tight to its place by means of the four finger screw knobs.

F. R. HASSLER.